INHIBITION OF GERMINATION OF ACTINOMYCETES SPORES IN A STATIONARY MAGNETIC FIELD

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16. Abstract

Stationary magnetic field (10,000 ersted) inhibits the germination of the spores of Actinomyces streptomycini B-6 and Thermoactinomyces vulgaris 136.

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The entire course of evolution of life on earth has taken place under /556* the effect of numerous external factors, the majority of which are of an electromagnetic nature. Therefore, it is important to study the reaction of biological systems to various components of electromagnetic radiation. In recent years this has been dealt with in a large number of works (Pavlovich, 1971; Klassen, 1971; Kovel'chuk, 1971; Tarakanova et al., 1972).

However, the results of these studies are far from equal in value and are contradictory.

Previously we studied paramagnetic centers of actinomycetes spores (Pozharitskaya et al., 1972) and it was shown that the germination of spores is connected with a sharp reduction in the "native paramagnetism of spores." /557 In germinating spores of the mesophilic strain Actinomyces streptomycini, no signals of Mn^{2+} or Fe^{3+} are recorded which are intensive in intact spores.

At the end of germination, spores of the thermophilic strain Thermoactinomyces vulgaris 136 contain practically no paramagnetic centers (Pozharitskaya et al., 1972). Therefore, it can be assumed that placing germinating spores in a magnetic field, as well as prior placement of a suspension of spores in a magnetic field, should inhibit germination; the anticipated effect should be quite clear because of the synchronism of the culture.

The present work is a study of the effect of a stationary magnetic field on the germination of actinomycetes spores. We studied the thermophilic or-

* Translator's Note: Numbers in margin indicate pagination of original foreign text.

ganism Thermoact. vulgaris 136 whose spores are similar to bacterial endospores in a number of ways (Dorokhova et al., 1968) and spores of the mesophilic strain Act. streptomycini B-6 which differ very little from vegetative cells. Information on these strains of actinomycetes and descriptions of procedures have been reported previously (Kalakutskiy et al., 1969; Agre et al., 1971).

As the source of the stationary magnetic field with an intensity of 10,000 H we used an FL-1 electromagnet fed by a direct electric current. To provide the most homogeneous magnetic field we used "shoes" 100 mm in diameter; distance between the poles was 25-30 mm. The intensity of the magnetic field was determined according to a calibrated curve of the electromagnet and controlled by an SMF-3. Experiments with a magnetic field were conducted at room temperature in thermostated chambers. We studied the effect of a magnetic field on the germination of spores and the effect of a stationary magnetic field on an aqueous suspension of spores.

The germination of spores in a magnetic field was studied by placing 0.1 ml of suspension with optic density of 0.2 (OD-0.2) on a glass plate with a nutrient medium. Control and test plates were placed in two identical thermostated chambers, series-connected with each other and with a U-8 ultrathermostat. The time which test plates were kept in the SMF was 5.5 hours for Act. streptomycini B-6 (at 28°) and 1.5 hours for Thermoact. vulgaris 136 (at 55°).

Aqueous suspensions of spores (OD=0.2) were placed in test tubes in the amount of 2 ml and exposed to the effect of a stationary magnetic field (SMF) for 1.5 hours at room temperature. The suspensions were screened 30 minutes after termination of the effect of the SMF. Control samples in all cases were placed outside the sphere of influence of the SMF.

We also compared the germination of spores of Act. streptomycini B-6 from an ordinary aqueous suspension and from a suspension prepared in water

exposed to the effect of a magnetic field.

Incubation time was 1.5 hours for Thermoact. vulgaris 136 at a temperature of 55°, 5.5 hours for Act. streptomycini B-6 at a temperature of 28°. After this time had elapsed, the percent of germination was calculated (table).

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(results given in % of germination)

Thermoact. vulgaris 136				Act. streptomycini			
Suspension of spores in test tube		Suspension of spores on a plate		Suspension of spores on a plate		Suspension of spores in water first treated with a SMF	
test	control	test	control	test	control	test	control
57	68	12	35	24	36	58	68
92	97	49	55	66	76	44	49
35	38	65	70	47	54	54	58
90	93	60	61	51	52	21	22

Unfortunately, the mechanism of the effect of a SMF on biological objects is at the present time still far from clear. It is safe to speak only of the consistent orienting effect of a stationary magnetic field with an intensity of 10^5 H on macromolecules of biological structures (Dorfman, 1962).

It is possible that in our case the magnetic field prevents the release of paramagnetic particles in the germination process.

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